CHAPTER 10

INCINERATORS

10-1. Incineration system description

Incineration of waste is an operation that includes feeding the furnace, burning the waste, exhausting the gases to the atmosphere, and removing the residue from the furnace. This chapter presents an overview of incinerators and associated fans, burners, and control equipment required for a complete refuse disposal system. Typical incineration system equipment is described, as well as guidelines for maintenance of such systems.

a. Waste classification. Incinerators and associated equipment are available in a wide variety of designs based on the type of refuse, unit capacity, and degree of process automation. For the purpose of this manual, discussion will be limited to manually fed, low capacity units (less than 250 pounds per hour) with dry paper as the primary waste. Dry paper matter is classified as a Type O waste with the following characteristics.

Moisture content	Less than 10 percent
Incombustible solids	5 percent
BTU value per pound	8,500
Weight per cubic foot	8 - 10 pounds

b. System design features. The feed system for incinerators may be automatic or manual (batch); however, for small scale systems associated with paper waste, the waste is typically batch-fed into a charging hopper or directly into the furnace. Auxiliary gas or oil burners assist in the combustion of the waste and help in maintaining the desired combustion temperature. The required furnace draft is provided by the stack or by an induced draft fan, and is monitored closely to ensure that the proper negative air pressure is maintained in the furnace. Residue generated from burning dry paper consists of a relatively fine, light ash. Removal of this residue from the furnace may be by automatic equipment or by manual means. For manually fed, low capacity incinerators as described in this chapter, ash removal is generally manual through cleanout doors located below the furnace grate.

10-2. Incineration system major components

Incineration systems are comprised of the following major system components.

a. Combustion chambers. The combustion chamber(s) of an incinerator enclose the combustion area and are typically constructed of an outer shell and an inner refractory material lining. Shell materials vary with size and age of the incinerator, and are usually brick for older built-up units and steel or cast iron for newer packaged units. The refractory lining serves to protect the shell from the high temperatures generated in the chamber. Incinerators may have one or two combustion chambers. Newer packaged incinerators generally will have two chambers (figure 10-1), primary (lower) and secondary (upper), whereas older built-up incinerators may have only a single combustion chamber.

(1) The primary combustion chamber houses the fixed grate or hearth, waste charging door, ash removal doors, and primary burner. Initial burning of the waste occurs in this chamber, with combustion air

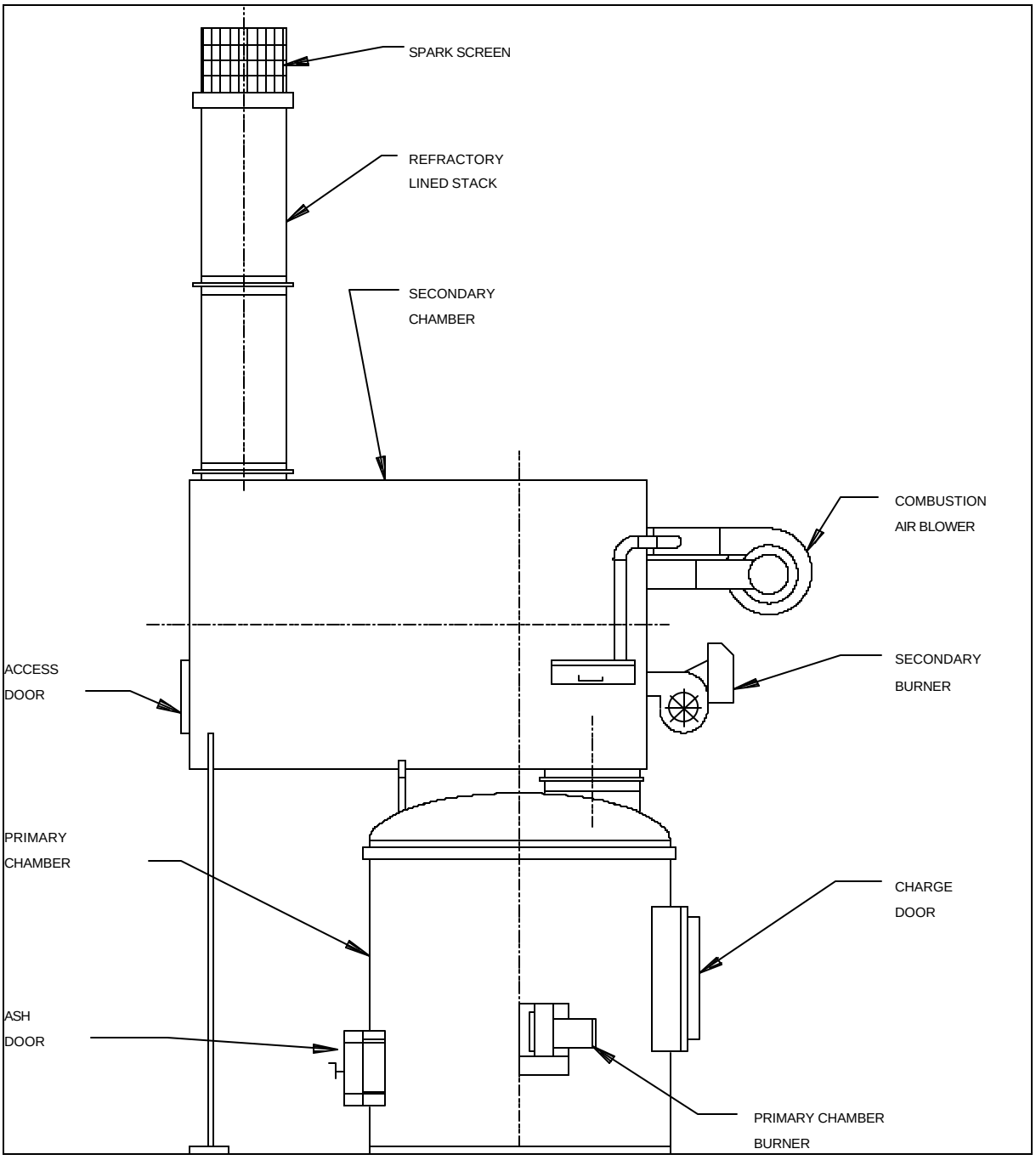

Figure 10-1. Vertical dual chamber incinerator

supplied in the grate area by air vents or by a combustion air blower. Partial combustion occurs in the primary chamber, with the hot gases generated flowing up into the secondary combustion chamber. The temperature within the primary chamber is maintained around 1,300°F by controlling the combustion air and the firing rate of the burner.

(2) Further combustion of the gases occurs in the secondary combustion chamber that is usually located above the primary chamber. Secondary combustion is augmented by an auxiliary burner, with air supplied by additional vents or blowers. To minimize pollution, the temperature within the secondary

chamber should be maintained at 1,800°F, and the residence time should be a minimum of two seconds. The combustion gases exit the secondary chamber and are discharged to the stack.

b. Burners. Incinerators will have auxiliary burners to assist in the combustion of the waste. Burners serving the primary combustion chamber heat and ignite the waste. Burners serving the secondary combustion chamber aid in maintaining the temperature required to minimize emissions. Incinerator burners may be natural gas or oil fired, with controls ranging from manual on/off operation to fully automatic modulating operation. Safety controls are typically provided to ensure proper burner ignition and operation, and to prevent flow of fuel into the chamber if ignition has not occurred.

c. Fans. Fans serving incinerator systems may be provided to supply combustion air (forced draft fans) or to aid in exhausting the flue gases from the incinerator to the stack (induced draft fans). The combustion air fans are generally the centrifugal type and are mounted on or near the combustion chambers. The induced draft fan is located in the flue gas stream between the incinerator and the stack. Induced draft fans are usually of centrifugal or axial design, and are constructed to handle the high temperatures and particulate of the combustion gases. Controlling the forced draft and induced draft fan output enables the proper temperature and draft (pressure) to be maintained within the incinerator. Fan output may be controlled by dampers or by variation of motor speed. Damper control generally consists of adjustable fan discharge dampers or adjustable fan intake dampers (inlet vanes). Motor speed control can be accomplished by several methods including use of variable speed direct current (DC) motors, use of multiple speed alternating current (AC) motors, or electronically adjustable motor drives. The pressure within the incinerator is usually monitored by a draft gauge calibrated in inches of water.

d. Air pollution control equipment. For the purpose of this manual, it is assumed that the low capacity incinerators located on existing sites are not equipped with air pollution (emission) control devices. A brief discussion of this equipment is provided since it is likely that systems may be required to be retrofitted in the future due to increasingly stringent regulations. Emission regulations vary from state to state, but generally speaking, low capacity (250 to 500 pounds per hour) incinerators are exempt from emission equipment requirements. Most states do, however, require that a temperature of 1,800^{o}F be maintained within the incinerator to ensure more complete combustion, thereby reducing emissions. Pollution control equipment serving incinerators includes wet and dry scrubbers, electrostatic precipitators, and baghouses. Any one or a combination of these devices may be used depending on the incinerator size, waste to be incinerated, system configuration, and emission regulations. Wet and dry scrubbers are generally used to neutralize the acid gases that are generated in the combustion process. The flue gases also contain a fine particulate matter that may be collected by an electrostatic precipitator or baghouse for complete emission control. Addition of pollution control equipment to an incinerator system will generally mandate the use of an induced draft fan to overcome the significant air resistance caused by this equipment.